Note on the Probable Errors of the Star Places of the Argentine General Catalogue for 1875, *and the Cape Catalogue for* 1880. By A. M. W. Downing, M.A.

As a supplement to my paper on the star places of the Argentine General Catalogue for 1875, and the Cape Catalogue for 1880, printed in the *Monthly Notices* for last June, the following values of the probable errors of a difference of the catalogue places at different N.P.D.s. may be of interest. In the calculation of these probable errors it has not been thought necessary to make use of all the available material, but only of that resulting from the comparison of the places of stars of R.A. 0^h–1^h, 6^h–7^h, 12^h–13^h, and 18^h–19^h.

The following table gives the results of the computation :—

N.P.D.	No. of Stars.	Probable Error of a Single $\Delta\alpha$	Probable Error of a Single $\Delta\alpha$ sin N.P.D.	Probable Error of a Single $\Delta\delta$
° °		s	s	″
90–100	38	± 0·050		± 0·76
100–110	36	± 0·064		± 0·62
110–115	91	± 0·048	± 0·052	± 0·57
115–120	194	± 0·054		± 0·51
120–125	207	± 0·059		± 0·56
125–130	194	± 0·068		± 0·56
130–135	200	± 0·065	± 0·051	± 0·54
135–140	181	± 0·074		± 0·46
140–145	194	± 0·089		± 0·47
145–150	178	± 0·084	± 0·047	± 0·50
150–155	133	± 0·088		± 0·48
155–160	93	± 0·111	± 0·041	± 0·55
160–165	84	± 0·127		± 0·71
165–170	63	± 0·201	± 0·043	± 0·52
170–180	47	± 0·291	± 0·025	± 0·62

The mean value of the probable error of a single $\Delta\alpha$ sin N.P.D. is $\pm 0^s{\cdot}047$; and, assuming that the star places in the two catalogues are equally free from accidental errors, we find that the probable error of a R.A. in either $= \pm 0^s{\cdot}033$ expressed in equatorial time. The mean value of the probable error of a single $\Delta\delta$ is $\pm 0''{\cdot}55$; and, on the same assumption, it follows that the probable error of a N.P.D. in either catalogue $= \pm 0''{\cdot}39$. It appears, however, from Herr Backlund's investigations (*V. J. S.* 20 Jahrgang, III. Heft) that the probable errors of a single Cape observation in R.A. and N.P.D. are $\pm 0^s{\cdot}046$ cosec N.P.D. and $\pm 0''{\cdot}61$ respectively, and as each place in the Cape Catalogue depends, on the average, on 3 observations, we have the probable

error of a R.A. in the Cape Catalogue = $\pm 0^s{\cdot}027$ cosec N.P.D., and the probable error of a N.P.D. = $\pm 0''{\cdot}35$. Combining these values with the probable errors of a single $\Delta\alpha$ sin N.P.D. and a single $\Delta\delta$ given above, it appears that the probable errors of a R.A. and N.P.D. of the Argentine General Catalogue are $\pm 0^s{\cdot}038$ cosec N.P.D. and $\pm 0''{\cdot}42$ respectively.

On the Reduction of Star Places by Bohnenberger's Method.
By Professor Truman Henry Safford.

Every astronomer who has had much to do with the reduction of star places from one epoch to another is aware that in case the star be very near the pole, or the epochs very distant, the method invented by Bohnenberger must replace the ordinary employment of annual precessions and secular variations.

It is easy enough to see that when the product of the interval by the tangent of the star's declination reaches a certain amount the precession series is no longer convergent. If I can rely upon my remembrance of a mathematical investigation found in many text-books, the series

$$1-\tfrac{1}{3}+\tfrac{1}{5}-\tfrac{1}{7}+\tfrac{1}{7}-\tfrac{1}{11}, \text{ etc. for } \tfrac{1}{4}\pi = {\cdot}78539\ \ldots$$

is just on the line between convergence and non-convergence; and when the series, by which the right ascension of a star is expressed in terms of the time, contains as a part of itself a series of this degree of convergence it is no longer practicable to use it.

From Bessel's investigation on pages x and xi of the introduction to the *Tabulæ Regiomontanæ*, one can readily enough see that a star's right ascension as a function of the time contains terms of the form

$$\begin{aligned} &tn \tan\delta \sin\alpha \\ &+\frac{t^2n^2}{2}\tan^2\delta\sin 2\alpha \\ &+\frac{t^3n^3}{3}\tan^3\delta\sin 3\alpha \\ &+\frac{t^4n^4}{4}\tan^4\delta\sin 4\alpha. \\ &+\ \&c. \end{aligned}$$

together with other terms multiplied by the same powers of tan δ, but lower power of the time. The terms here given are those which determine the convergence when tan δ is very great.

If, now, $tn \tan\delta = 1$ we shall have a series which exhibits precisely the same kind of lack of convergence as the well-known numerical arc which I quoted before.

As n is roughly $20''$ or $\frac{1}{10000}$ of radius, it is plain that this